REMARKS

Page 2 of the January 16 Office Action and the Office Action Summary incorrectly indicate that claims 1-42 are presented for examination and claims 1-42 are rejected. Upon contacting the Examiner, verbal confirmation was made that claims 1-43 of this application are pending and that claims 1-43 stand rejected.

Claims 1-44 are pending. By this Amendment, claims 12, 19 and 28 are cancelled, claims 1, 20, 21, 22, 37, 38 and 41 are amended, and claim 44 is added. The claims are amended for clarity and not to overcome the prior art as discussed below. Reconsideration based on the above amendments and following remarks is respectfully requested.

The attached Appendix includes marked-up copies of each rewritten claim (37 C.F.R. §1.121(c)(1)(ii)).

Applicant appreciates the courtesies extended to Applicant's representatives by Examiners Pecone and Frejd in the March 6, 2002, personal interview.

I. CLAIMS 1, 8, 10-12, 28, 42 AND 43 SATISFY THE REQUIREMENTS OF 35 U.S.C. §112, SECOND PARAGRAPH

The Office Action rejects claim 1 under 35 U.S.C. §112, second paragraph. Claim 1 has been amended to obviate this rejection. Claim 22 has also been amended to make it consistent with amended claim 1.

The Office Action also rejects claims 8, 10-12, 28, 42 and 43 under 35 U.S.C. §112, second paragraph. Applicant respectfully traverses the rejection and strongly asserts that the definiteness of the claim language must be analyzed in light of teachings of the prior art and the specification as it would be interpreted by one of skill in the art (MPEP 2173.02).

As pointed out during the March 6 Personal Interview, Applicant respectfully submits that the specification provides ample support for the various claim features recited in claims 8, 10-12, 28, 42 and 43. Furthermore, Applicant submits that the claim features recited in

claims 8, 10-12, 28, 42 and 43 are clearly described and fully enabled to one of ordinary skill in the computer-aided simulation and/or vision system design arts.

Applicant respectfully submits that claims 1, 8, 10-12, 28, 42 and 43 satisfy the requirements of 35 U.S.C. §112, second paragraph and respectfully requests the withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

II. THE CLAIMS DEFINE ALLOWABLE SUBJECT MATTER

The Office Action, in Item 8, indicates that each model in claim 1 (virtual world, and optical system) will be interpreted to be programmed model files of a CAD model system (i.e., DWG files, etc.). The Office Action further indicates that each model in claim 8 (world, static, stage, and component) will be interpreted to be programmed model files of a CAD model system (i.e., DWG files, etc.). Applicant respectfully disagrees with this interpretation.

As pointed out during the March 6 Personal Interview, Applicant submits that, in various exemplary embodiments, the world, static, stage, component, and optical system models represent virtual models of a vision system hardware components simulation system. While, in some exemplary embodiments, CAD models of workpieces may be imported and fixed onto a virtual stage of the vision system hardware components simulation system, the models in claims 1 and 8 are not restricted to programmed model files of a CAD model. Furthermore, applicant submits that, in various exemplary embodiments, the processor that generates an image of the virtual world is not restricted to operating on the data typically found in CAD models. Appropriate interpretation of the world, static, stage, component, and optical system models, as recited in claims 1 and 8, is respectfully requested.

The Office Action rejects claims 1-9, 13-27 and 29-40 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 6,064,759 to Buckley et al. (hereinafter "Buckley"); and

rejects claim 41 under 35 U.S.C. §103(a) as being unpatentable over Buckley in view of U.S. Patent 6,301,763 to Pryor (hereinafter "Pryor"). These rejections are respectfully traversed.

Buckley discloses a geometric simulation of structured light based shape-determining system which uses geometric data of a part to identify which portions of an actual part are required to be inspected and geometrically maps those portions to respective windows of column and row values of CCD camera pixels based on the geometry of a sensor, camera and the light source. In Buckley, the object is to efficiently eliminate image data which is not needed for the purpose of characterizing the shape of an actual part captured using a camera system.

Buckley does not disclose a second model of an optical system of a machine vision system being simulated and generating a simulated image based on that model, as recited in independent claims 1 and 22, or of the similar features set forth in claims 37 and 41. In contrast to the features recited in claims 1-36, 39, 42 and 44, Buckley's geometric mapping teachings do not disclose, teach or suggest a model of at least an optical system including parameters usable to simulate vision system images including effects at least due to focus. In contrast, Buckley's purely geometric teachings deemphasize or ignore image effects, as emphasized by Buckley's teaching regarding the analysis of actual structure light stripe images to determine the object shape, as disclosed at col. 6, lines 40-50: "[t]his centroid calculation is a robust one, as variations in the surface reflectivity (e.g., smears of grease or discoloration) may change the voltage level of the bright pixels in row m, but have little effect on the location of the centroid. Similarly, the centroid calculation is insensitive to whether the surface reflects specularly or diffusely so long as enough light is reflected that the illuminated pixel voltages are much larger than the unilluminated ones." Thus, Buckley has no need for, and thus can not teach, disclose or suggest the second model of an optical system recited in claims 1-36, the rendering step recited in claims 37-40, or the rendering step

of claims 41-44. Claims 7, 10-12, 23, 39, 42 and 44 also further define the second model or rendering features of claims 1, 22, 37 or 41. Additionally, as set forth in claim 17, the second model characterizes at least one of an aperture, a focal length, an image magnification, and an optical system geometry of the lens system.

More generally, Buckley does not disclose, teach or suggest including out-of-focus images in the results of the simulation or suggest that a simulation and/or rendering supports a simulated user interface. The amendments to claims 1, 22, 37 and 41 clarify that Applicant's invention encompasses these features.

Pryor fails to make up for the above deficiencies in Buckley. Pryor is directed toward simulating operations such as robotic assembly or handling. Pryor is directed primarily to designing special high-contrast targets to be applied to real objects, such that offline simulations of robot operations including vision-based robot guidance can fail to realistically simulate images, while the special targets are more likely to allow the simulation results to be matched in the real world. In Pryor, as disclosed at col. 12, lines 32 to 36, "[a]nd too, one is dealing with mathematical representations of target points and photogrammetric equations, not relatively unknown functions of vision systems with gray level images of object features. Simulation of dynamic target tracking also become feasible as the problem is much more defined than with gray level scene analysis." In contrast to the features recited in claims 1-36, 39, 42 and 44, Pryor's teachings do not disclose, teach or suggest a model of at least an optical system including parameters usable to simulate vision system images including image effects at least due to focus. For example, Pryor does not disclose, teach or suggest including out-of-focus images in the results of the simulation. Rather, Pryor teaches providing special targets to avoid the need for simulating such image effects.

For at least these reasons, Applicant respectfully submits that Buckley, either alone or in combination with Pryor, fails to teach, disclose or suggest all of the features of

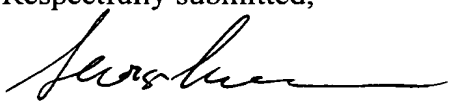
claims 1-44. Thus, Buckley, either alone or in combination with Pryor, fails to render obvious the subject matter of claims 1-44 under 35 U.S.C. §103(a). Withdrawal of the rejections of claims 1-43 under 35 U.S.C. §103(a) as unpatentable over Buckley, either alone or in combination with Pryor, is respectfully requested.

III. CONCLUSION

For at least the reasons discussed above, it is respectfully submitted that this application is in condition for allowance. Favorable consideration and prompt allowance of claims 1-44 is respectfully requested.

Should the Examiner believe that anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the Applicant's undersigned representative at the telephone number listed below.

Respectfully submitted,



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APPENDIX

Changes to Claims:

1. (Amended) A vision system hardware component simulation system ~~for~~ corresponding to a machine vision system, comprising:

a first model representing at least one object;

a second model representing at least an optical system corresponding to a machine vision system being simulated; and

a processor that generates ~~an~~ focus-dependent image of a virtual world containing the at least one object based upon the first model and the second model, the image presented through a user interface representative of a user interface of the machine vision system being simulated.

20. (Amended) The vision system hardware component simulation system of claim 1, further comprising ~~a user interface includes~~ means for modifying at least one of the first and second models.

21. (Amended) The vision system hardware component simulation system of claim 1, ~~further comprising a user interface for a machine vision inspection system to simulate,~~ wherein the ~~user interface simulating~~ vision system hardware component simulation system simulates at least one operation of the machine vision inspection system independent of at least one component of the machine vision inspection system.

22. (Amended) A method for simulating images based on the characteristics of at least one machine vision hardware component, comprising:

generating a simulated focus-dependent image of a virtual world containing at least one object based upon a first model that characterizes the at least one object and a second model that characterizes an optical system of a machine vision system being simulated; and

providing the simulated image to a user interface representative of a user interface of the machine vision ~~control~~ system being simulated.

37. (Amended) A method for facilitating the generation of at least one machine control instruction for a machine having a machine vision system independently of at least one element of the machine vision system, the method comprising:

rendering a synthetic image of at least one object as viewed through the machine vision system based on a representation of at least one component of the machine vision system;

providing the synthetic image to a user interface representative of a user interface of the machine vision system; and

selecting a machine control instruction based at least in part on the synthetic image.

38. (Amended) The method of claim 37, wherein rendering the synthetic image comprises updating in real-time ~~a view of the at least one object through the simulation of the machine vision system~~ the synthetic image in response to ~~the~~ a user altering the representation of ~~the~~ at least one component of the machine vision system.

41. (Amended) A method for generating a synthetic image independently of at least one element of a machine vision system, the synthetic image simulating an image from the machine vision system, the method comprising:

initializing a scene of the synthetic image of at least one object as viewed through the machine vision system;

adding a workpiece model of at least one workpiece to the scene, the at least one workpiece positioned on a stage of the scene;

obtaining at least one of a position and an orientation of the stage relative to an optical system of the machine vision system; ~~and~~

providing the simulated image to a user interface representative of a user interface of the machine vision ~~control~~ system being simulated.

37. (Amended) A method for facilitating the generation of at least one machine control instruction for a machine having a machine vision system independently of at least one element of the machine vision system, the method comprising:

rendering a synthetic image of at least one object as viewed through the machine vision system based on a representation of at least one component of the machine vision system;

providing the syntetic image to a user interface representative of a user interface of the machine vision system; and

selecting a machine control instruction based at least in part on the synthetic image.

38. (Amended) The method of claim 37, wherein rendering the synthetic image comprises updating in real-time ~~a view of the at least one object through the simulation of the machine vision system~~ the synthetic image in response to ~~the~~ a user altering the representation of ~~the~~ at least one component of the machine vision system.

41. (Amended) A method for generating a synthetic image independently of at least one element of a machine vision system, the synthetic image simulating an image from the machine vision system, the method comprising:

initializing a scene of the synthetic image of at least one object as viewed through the machine vision system;

adding a workpiece model of at least one workpiece to the scene, the at least one workpiece positioned on a stage of the scene;

obtaining at least one of a position and an orientation of the stage relative to an optical system of the machine vision system; ~~and~~

rendering the scene based on at least one of the characteristics of the optical system and the obtained relative position and orientation of the optical system to generate the synthetic image; and

providing the synthetic image to a user interface representative of a user interface of the machine vision system.